

ENGINEERING Junior Design ME 80

Course Syllabus Spring – 2022

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Textbooks

None – will use a pdf that is copyright free

Class Times

- Lecture/discussions:TBD

Prerequisites

Junior Status

Course Description

This course provides theory and application of engineering design. We will cover a cutting-edge design process and methods called Design Innovation. The course will implement this process to design a product, process or service for a stakeholder. This will be a technical service-oriented project; likely designing for under resourced stakeholders. The class will involve work in small design teams and will necessitate working to gain deep understanding of, and empathy for, those we are designing for. We will produce design process artifacts as well as functional prototypes. Clear correlation to Christian values of helping others will be a constant focus.

Course Learning Outcomes

1. Students will be able to qualitatively and quantitatively analyze systems they are designing
 - Westmont Institutional Learning Outcomes: Critical Thinking; Quantitative Literacy
 - ABET Student Outcome: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
 - Method of Assessment – Case Studies, design documents
2. Students will be able to accurately design products, process and systems to help stakeholders
 - Westmont Institutional Learning Outcomes: Critical Thinking; Quantitative Literacy; Written Communication
 - Address the role our design work can play to help people
 - Address the wonder and beauty of the intricacy of designing with empathy for people from a theological perspective
 - ABET Student Outcome: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
 - Method of Assessment –Discussions, prototypes and Report Submissions
3. Students will be able to accurately design products, processes & systems to accomplish a set of design requirements and describe impact of advances of technology in society
 - Westmont Institutional Learning Outcomes: Critical Thinking; Quantitative Literacy; Written Communication
 - Address the role we can play in design of products to help people
 - Address the wonder and beauty of the intricacy of design for service to others

- ABET Student Outcome: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- Method of Assessment –Discussions, prototypes, design presentations and Report Submissions
- 4. Students will be able to communicate their design process and decisions to others; gaining insight to iteratively improve their design.
 - Westmont Institutional Learning Outcomes:
 - Christian Understanding, Practices and Affections and Oral Communication
 - Written Communication
 - ABET Student Outcome: an ability to communicate effectively with a range of audiences

Evaluation

There will be two design presentation and a final report during the semester. The design presentations will be attended by stakeholders. Peer evaluations will work to ensure that all team members share the workload. Homework will include incremental turn in of design process documents and hardware.

Attendance

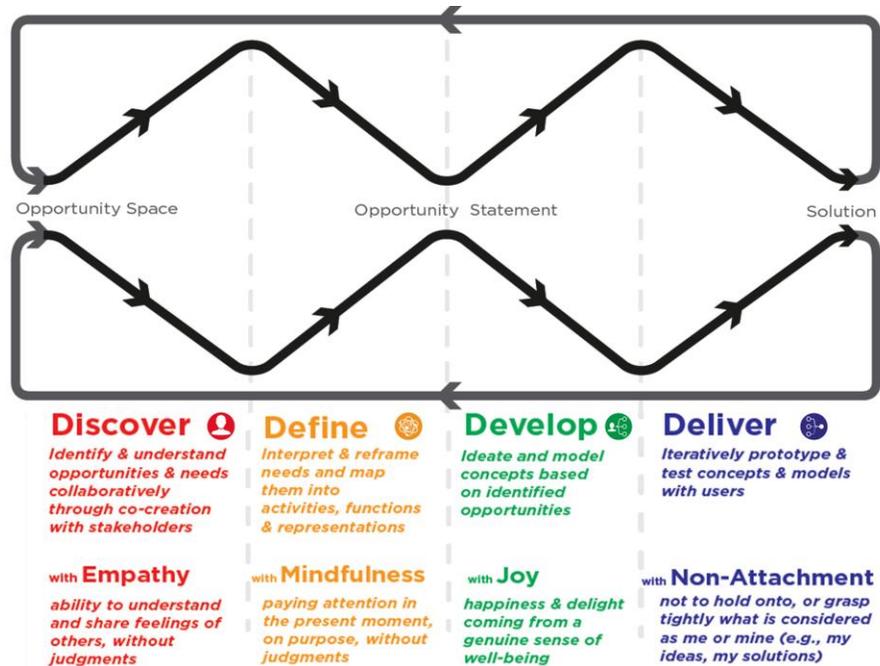
Class attendance in LECTURE is expected and has a direct impact on ability to participate. It is impossible to receive full credit on a laboratory activity without being present. However, there may be an unexpected circumstance where a student must miss a class. Students involved in extracurricular activities sponsored by the college will be excused for all scheduled events inclusive of the above policy. Since arriving late to class is disruptive, please be on time.

Specific Course Details Related to GE Requirements

Students will engage in a Design Innovation (DI) process that is structured in accordance with the 4-D model shown below. This is relevant to the concept of “Serving Society”, as all 4 of the phases or steps in the DI process involve significant interaction and collaboration with the stakeholders we are designing for. Specifically, the 1st D – Discover - entails understanding the needs of the stakeholders with a focus on empathy. Students will have significant interaction with the stakeholders (in this particular case the people in the under-resourced area) as well as the people from the NGO (in this case Compassion International). To the extent possible, these interactions will be extensive enough for the designers (students) to gain both detailed understanding of the opportunity we are designing toward and significant empathy for the people with the unmet need we are addressing. The 2nd D – Define - provides a set of methods from systems engineering that take the information we have gained in the Discover phase and allow us to develop models that highlight specific innovation opportunities. One method employed in this Define phase is called Journey Mapping and provides insights that often lead to opportunities to address systemic or structural concerns related to the unmet need. The method does this by modeling tasks, information flow and even emotions of the stakeholders as they are engaged in the context of the unmet need. The 3rd D – Develop – is a phase where we develop a large quantity and variety of potential ways to address the unmet need. To the extent possible, this is done WITH the stakeholders creating an environment where we strive to CO-CREATE with the stakeholders. Finally in our 4th D – Deliver – we prototype and test our ideas and bring them back to the stakeholders for their input. This often leads to the need for significant redesign as stakeholders reveal aspects of the design that may not fit well in the stakeholder’s culture or preferences.

DI: People, Methods, Process, Principles

The 4Ds



Grading:

1. Design review #1: 20%
2. Design review #2: 25%
3. Final prototypes: 30%
4. Final report: 25%

Cultural Awareness project – In teams of two, students will research a technological advancement related to control systems. They will write about the cultural impact of that advancement, discussing how different subgroups within the society were impacted and how the advancement helped or hindered them. Issues such as the role control systems play in energy reduction and sustainability as well as the role of controls in IoT systems could be addressed. The report will be 2 pages, with a brief oral presentation to the class.

Grading scale:

A = 93-100%	B = 83-87%	C = 73-77%	D = 63-67%
A- = 90-92%	B- = 80-82%	C- = 70-72%	D- = 60-62%
B+ = 88-89%	C+ = 78-79%	D+ = 68-69%	F = 60% and below

Academic Accommodations

Students who have been diagnosed with a disability are strongly encouraged to contact the Office of Disability Services as early as possible to discuss appropriate accommodations for this course. Formal accommodations will only be granted for students whose disabilities have been verified by the Office of Disability Services. These accommodations may be necessary to ensure your equal access to this course.

Please contact Sheri Noble, Director of Disability Services. (310A Voskuyl Library, 565-6186, snoble@westmont.edu) or visit the website for more information: <https://www.westmont.edu/disability-services>

Westmont College Statement of Academic Dishonesty

Westmont policies and procedures state that any sign of academic dishonesty including *plagiarism* (the use of someone else's words or ideas without giving proper credit), *cheating* (the use of unauthorized sources of information on an examination or some other assignment) or *falsification* (the misrepresentation of facts in any academic project or obligation) could result in a failing grade in any given course and the filing of a report with the Provost's Office. Be familiar with the College's plagiarism policy, found at: <https://www.westmont.edu/office-provost/academic-program/academic-integrity-policy>

Content for each week is described below

Week	Content
1	Introduction, Overview of 4 D's of design – MBTI overview - Designette Description - Functional Decomposition, Ideation, Decision analysis, Prototyping
	Designette Overview + Team Time (TT) - Designette
2	Project Selection Discussion + Team Time (TT) for Designette work
	In-class Designette briefs
3	D1- DISCOVER: Mindset + Stakeholder Analysis + Individual Team Project Refinement
	D1- DISCOVER: Interviews, Personas, Scenarios, Affinity Analysis
4	D1- DISCOVER: TT for interviews + Team MBTI Coaching
	D1- DISCOVER: Ethics Overview TT for interviews
5	D2- DEFINE: Functional Decomposition – Activity Diagrams and Journey maps
	D3- DEVELOP: Mind Maps
6	TT - PDR preparation
	TT - PDR preparation
7	PDRs (teams TBD) – 15 min each
	PDRs (teams TBD) – 15 min each
8	PDRs – 15 min each
	D3 - Develop: Word Vis & AskNature added to Mind Map

9	Comp day – no class
	D3 - DEVELOP: C-Sketch (6-3-5) Rotational Drawing
10	D3 - DEVELOP: Real-Win-Worth + Decision Matrices
	D4 - DELIVER: TT catch up on any methods
11	D4 - DELIVER: Prototyping
	D4 - DELIVER: CDR Overview
12	D4 - DELIVER: TT – Prototype, CDR and Final Report Prep
	D4 - DELIVER: TT - Prototype, CDR and Final Report Prep
13	D4 - DELIVER: TT - Prototype, CDR and Final Report Prep
	D4 - DELIVER: TT - Prototype, CDR and Final Report Prep
14	D4 - DELIVER: CDR Practice
	D4 - DELIVER: CDR Practice
15	CDR - teams 1-5
	CDR - teams 6-10